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Occupation and Risk of Non-Hodgkin Lymphoma and Its Subtypes: A Pooled Analysis from the InterLymph Consortium

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Abstract

Background: Various occupations have been associated with an elevated NHL risk but results have been inconsistent across studies.

Objectives: To investigate occupational risk of non-Hodgkin lymphoma (NHL) and four common NHL subtypes with particular focus on occupations of *a priori* interest.

Methods: We conducted a pooled analysis of 10,046 cases and 12,025 controls from 10 NHL studies participating in the InterLymph Consortium. We harmonized the occupational coding using the 1968 International Standard Classification of Occupations (ISCO) and grouped occupations previously associated with NHL into 25 *a priori* groups. Odds ratios (OR), adjusted for center, age and sex were determined for NHL overall and the subtypes diffuse large B-cell lymphoma (DLBCL), follicular lymphoma (FL), chronic lymphocytic leukemia/small lymphocytic lymphoma (CLL/SLL) and peripheral T-cell lymphoma (PTCL).

Results: We confirmed previously reported positive associations between NHL and farming occupations (field crop/vegetable farm workers OR = 1.26; 95% confidence interval (CI): 1.05, 1.51; general farm workers OR = 1.19, 95% CI: 1.03, 1.37), and with specific occupations as women's hairdressers (OR = 1.34; 95% CI: 1.02, 1.74), charworkers/cleaners (OR = 1.17; 95% CI: 1.01, 1.36), spray-painters (OR = 2.07; 95% CI: 1.30, 3.29), electrical wiremen (OR = 1.24; 95% CI: 1.00, 1.54), and carpenters (OR = 1.42; 95% CI: 1.04, 1.93). We observed subtype specific associations for DLBCL and CLL/SLL in women's hairdressers and for DLBCL and PTCL in textile workers.

Conclusions: Our pooled analysis of 10 international studies adds to evidence suggesting that farming, hairdressing, and textile industry-related exposures may contribute to NHL risk.

Associations with women's hairdresser and textile occupations may be specific for certain NHL subtypes.

Introduction

Non-Hodgkin lymphoma (NHL) comprises a group of malignancies which are common in industrialized countries. Studies of occupational risk factors have proven valuable for generating hypotheses into the possible environmental causes of NHL and over the past four decades have produced a number of strong leads (Schottenfeld and Fraumeni 2006). In particular, occupations involving exposure to pesticides and solvents have been repeatedly associated with NHL. Other occupational risk factors have been hypothesised, such as infectious agents, sunlight, organic dusts (including flour dust, textile dust and wood dust), mineral dusts, metals and ionizing radiation. Nevertheless, even repeatedly observed associations (e.g. employment as farmer) have not been entirely consistent across studies. A well-defined set of occupations and potential exposures relevant to NHL etiology has yet to be established.

Among potential reasons for the lack of consistency in previous findings are that individual case-control studies lack the power to provide stable estimates of relative risk for less common occupations and are susceptible to chance findings because of the large number of occupations evaluated. Studies differ somewhat in how occupational details are recorded, coded, analysed and reported, making comparison difficult, and may not be comparable in terms of the NHL subtypes included and tumour classifications used. Finally, there may be true differences in risk associated with the same occupation across different study regions due to local differences in population characteristics, exposure patterns and NHL subtype distribution.

To determine the extent of agreement with previous findings in the large pooled dataset of InterLymph consortium studies, we conducted an analysis of occupation in relation to NHL, using a uniform classification of occupation and NHL pathology. Our aim was (a) to confirm the

relationship of occupations of *a priori* interest with NHL and its subtypes, and (b) to estimate the contribution of specific occupations of *a priori* interest to the incidence of NHL and its subtypes.

Methods

Study population. Included in our analyses were 10 NHL case-control studies that participate in the InterLymph consortium, had collected information on occupation from cases and controls, and were willing to contribute their data in the pooled analysis (see Table 1 for the acronyms used to refer to each study, details about study designs and locations, and citations to general references for each study). The InterLymph consortium of international investigators undertakes research projects to pool data across studies that explore the aetiology of lymphoid malignancies. The set of harmonized core variables, including age, sex, study centre (region), smoking and NHL subtype, was directly obtained from the InterLymph data coordinating centre. Variables on occupational history were obtained from the principal investigators of each participating study. We applied the lymphoma classification scheme for epidemiologic research developed by InterLymph investigators (Morton et al. 2007) to all participating InterLymph studies. All cases classified as "lymphoid neoplasms" according to this classification, except multiple myeloma and Hodgkin lymphoma, were included in this analysis.

Occupational history. For the purpose of our pooled analyses, the data on occupation were classified into a standard internationally recognized occupational classification scheme, the International Standard Classification of Occupations (ISCO) 1968 (ILO 1981). Depending on the original occupational classification used by the individual studies and whether full-text occupation was available, the ISCO 68 code for each job recorded was determined by either: (1) a direct conversion of the original classification to the ISCO 68 classification (for the Yale and UCSF1 studies); (2) a direct conversion from the original classification to ISCO 68 followed by

checking the correctness of each ISCO 68 code by comparing it with the free-text information on occupation (for the NCI-SEER study); (3) using the free-text occupation to individually assign the ISCO 68 code (for the BC, Nebraska, UK and NSW studies); or (4) directly using the original occupational codes for those studies that used ISCO 68 as their original classification (for the EPILYMPH, ITALY and ENGELA studies). Eight of the 10 studies collected the full occupational history of cases and controls including all occupations held for at least 1 year and starting and ending years, while two studies (Nebraska, BC) recorded only the longest-held occupation.

We defined occupational groups of *a priori* interest for NHL based on the peer-reviewed literature (Table 2). After discussions among three of the authors (A'tM, AJD, RV), 25 occupational groups were constructed including jobs associated with NHL in previous studies, other than the 10 case-control studies included in our pooled analysis.

We also studied occupations within a group separately up to the detail of the 5-digit ISCO code to explore whether an association was restricted to specific occupations within the group. For example, crop farmers were studied as a group and specific occupations within this group such as orchard farmers and rice farmers were also studied separately.

Statistical analyses. Unconditional logistic regression was used to calculate odds ratios (ORs) and 95% confidence intervals (CIs) for the association between NHL and occupations in the pooled dataset in models adjusted for age, sex and study centre. For each *a priori* occupational group and individual ISCO 68 occupation defined by a 1-digit, 2-digit, 3-digit, and 5-digit code, a dichotomous variable was created for ever having worked in that occupation. Duration of employment was coded as <1 year, 1-10 years, and >10 years in the occupation. Smoking

(never/ex/current) was considered as a potential confounder, but adjusting for smoking made no substantial difference to the relative risk estimates (data not shown) and consequently smoking was not included as a covariate.

Analyses were performed for all NHL combined (excluding Hodgkin lymphoma and multiple myeloma) and separately for each of four main NHL subtypes (diffuse large B-cell lymphoma [DLBCL]; follicular lymphoma [FL]; chronic lymphocytic leukemia/small lymphocytic lymphoma [CLL/SLL]; and peripheral T-cell lymphoma [PTCL]) using for each subtype the same set of all controls used for all NHL combined. Two studies did not include CLL/SLL (UCSF1; UK) and were excluded from all CLL/SLL specific analyses. All analyses were repeated stratified by gender. All statistical tests were two-sided with a significance level of 0.05. The Nebraska and BC studies included longest-held occupation only and were excluded from analyses of duration but were included in analyses of ever-employment since their exclusion made little difference to the results.

Polytomous regression was used to test whether differences in ORs by NHL subtype were statistically significant with p-value<0.05; we tested for heterogeneity in effect across the four subtypes (DLBCL, FL, CLL/SLL, PTCL) based on data for ever employed in the occupation, with both genders combined. We tested for heterogeneity among studies using Cochran's Chi^2 test or Q-test (Higgins and Thompson 2002): there was no evidence of significant heterogeneity (data not shown). To identify those associations with the largest potential impact on NHL incidence, under the assumption of causality and the absence of confounding, we calculated a population attributable fraction (AF) for occupations in which 1% or more of cases ever worked and which were associated with an increased relative risk. The formula for AF calculation used

the prevalence of ever worked in each occupation in controls as an estimate of population prevalence: $prevalence_{controls}*(OR-1)/(1+prevalence_{controls}(OR-1))$ (Last et al. 1995).

Criteria for presentation of results. The current analysis involves many specific occupations within the 25 *a priori* groups for which previous research demonstrated an association with an increased NHL relative risk: 925 of over 2000 relevant codes in the ISCO 68 classification. We set criteria to determine which associations to include in the results tables. We present results for ever employment and >10 years employment for all NHL and each of the four subtypes for each occupational group of *a priori* interest, regardless of whether estimates were statistically significant, with the exception of occupational groups with <10 cases or <10 controls. One occupational group in analyses of all NHL (undertakers) and two groups in analyses of the four subtypes (pulp&paper workers; petroleum workers) were excluded from the results because they had <10 cases or <10 controls. Additionally, we report associations with specific occupational titles included within the occupational groups of interest if we estimated a statistically significant odds ratio (OR) (> 1.10 or <0.90, for ever employment or >10 years employment) based on men and women combined, for all NHL or for any one of the four subtypes.

ORs were also calculated for the 1,286 occupations that were additional to the 25 groups of *a priori* interest. These results are not presented here but are available on request to the authors.

Results

The 10 case-control studies included 10,046 cases and 12,025 controls (Table 1). Of the cases, 50% were from Europe, 43% from North America and 7% from Australia. The diagnosis year ranged from 1988 to 2004, and 52.4 % of cases were male. The mean age at interview was 57.6 years for cases (standard deviation (SD) 12.8) and 55.4 for controls (SD 14.2). The mean year of

first employment (in the 8 studies with full occupational history) was 1959 for cases (SD 16; range 1915-2003) and 1961 for controls (SD 16; range 1912-2002). Of the four subtypes selected for separate analyses, DLBCL formed the largest group with 3,061 cases (52.4% male), followed by FL (2,140 cases; 45.6% male), CLL/SLL (1,014 cases; 59.3% male) and PTCL (632 cases; 56.5% male).

None of the 24 broad occupational groups of *a priori* interest (see Table 2) had a statistically significant positive association with NHL for ever employment (Table 3). One or more specific titles, however, within 10 of these 24 groups were positively associated with NHL. There were positive associations for ever employment in cleaning occupations for 'charworkers, cleaners and related' (OR=1.17; 95%CI: 1.01, 1.36), in electrical&electronic occupations for 'electrical wiremen' (OR = 1.24; 95%CI: 1.00, 1.54) and also for >10 years employment for 'electrical fitters & related electrical/electronics workers' and selected subgroups of these occupations. Among farming occupations, ever worked as 'field crop & vegetable farm workers' (OR = 1.26; 95% CI: 1.05, 1.51) and 'general farm workers' (OR = 1.19; 95%CI: 1.03, 1.37) had a positive association with NHL. More than 10 years as a 'forestry worker' also was associated with NHL (OR = 2.25; 95% CI: 1.18, 4.32; 28 cases, 14 controls). Other positive associations were observed for NHL for ever employment as a 'women's hairdresser' (OR = 1.34; 95% CI: 1.02, 1.74), among painters as 'spray-painters (except construction)' (OR = 2.07; 95% CI: 1.30, 3.29), among textile workers 'milliners and hatmakers' (OR = 2.46; 95% CI: 1.28, 4.74) and among wood worker occupations 'general carpenter' (OR = 1.42; 95% CI: 1.04, 1.93). More than 10 years employment was positively associated with NHL among medical workers for 'medical doctors' (OR = 1.87; 95% CI: 1.23, 2.85; 57 cases, 38 controls) and among metal workers for 'machine-tool operators' (OR = 1.55; 95% CI: 1.11, 2.17; 84 cases; 84 cases, 63 controls). The

occupational group of teachers was negatively associated with NHL (OR = 0.89; 95% CI: 0.81, 0.98), as were some of the specific occupations within the teachers group. Only 'head teachers' had a positive association with NHL (OR = 2.16; 95%CI: 1.15, 4.06).

Table 4 presents ORs and 95% CIs for the four NHL subtypes, for both genders combined. DLBCL, the most numerous subtype, had positive associations with the occupational groups of 'hairdressers' (OR = 1.47; 95% CI: 1.08, 2.00; 58 cases, 158 controls) and textile workers (OR = 1.19; 95% CI: 1.01, 1.41; 218 cases, 773 controls) and also specific occupations within these groups (women's hairdresser; milliners and hatmakers, sewers and embroiderers). Positive associations were also observed for specific occupations as 'charworkers, cleaners and related workers' (OR = 1.27; 95% CI: 1.03, 1.58; 122 cases, 395 controls), 'field crop & vegetable farm workers' (OR = 1.50; 95% CI: 1.15, 1.97; 79 cases, 233 controls) and its subgroup 'field crop farm worker (general)', 'metal melters and reheaters' (OR = 2.31; 95% CI: 1.01, 5.26; 10 cases, 14 controls), and 'special education teachers' (OR = 1.94; 95% CI: 1.01, 3.71; 14 cases, 24 controls). Forestry workers with >10 years employment also had a positive association for DLBCL (OR = 3.04, 95% CI: 1.34, 6.90; 10 cases, 14 controls).

Positive associations were present for FL for specific occupations as 'spray-painter (except construction)' (OR = 2.67; 95% CI: 1.36, 5.25; 13 cases, 29 controls) and for > 10 years employment as a 'medical doctor' (OR = 2.23, 95% CI: 1.17, 4.26; 13 cases, 38 controls).

CLL/SLL was associated with ever employment in the occupational group of hairdressers (OR = 1.79; 95% CI: 1.06-3.03; 18 cases, 130 controls), for the specific occupation as 'women's hairdresser' and also for >10 years employment in the occupational group of hairdressers (OR = 2.09, 95% CI: 1.01, 4.34; 10 cases, 40 controls). We observed positive associations for specific

occupations as 'general farm worker' (OR = 1.44; 95% CI: 1.13, 1.84; 102 cases, 399 controls), printing pressmen (OR = 6.52; 95% CI: 2.79, 15.21; 10 cases, 19 controls) and pre-primary education teachers' (OR = 2.00; 95% CI: 1.04, 3.87; 11 cases, 111 controls) and carpenters (OR = 2.10; 95% CI: 1.08, 4.09; 13 cases, 69 controls). CLL/SLL was associated also with >10 years employment as machine tool operators (OR = 1.96; 95% CI: 1.04, 3.69; 15 cases, 46 controls).

Three occupational groups had positive associations with PTCL: ever employment as painters (OR = 1.80; 95% CI: 1.14, 2.84; 22 cases, 221 controls), textile workers (OR = 1.60; 95% CI: 1.18, 2.17; 56 cases, 773 controls) and wood workers (OR = 1.54; 95% CI: 1.04, 2.27; 31 cases, 352 controls), the latter two also having increased ORs for >10 years employment. Specific textile occupations associated with PTCL included 'spinners, weavers, knitters, dyers & related workers' (OR = 1.85; 95% CI: 1.21, 2.83; 27 cases, 313 controls) and 'tailors, dressmakers, sewers, upholsterers & related workers (>10 y OR = 2.29, 95% CI: 1.38, 3.77, 19 cases, 183 controls). The specific wood worker occupation associated with PTCL was 'cabinet makers' (OR = 2.41; 95% CI: 1.22, 4.74; 10 cases, 81 controls). PTCL was also associated with 'electrical fitters' (ever employed OR = 2.02; 95% CI: 1.03, 3.97; 10 cases, 92 controls).

Evidence of heterogeneity in relative risks ($p < 0.05$, Q-test for heterogeneity) across the 4 NHL subtypes was present for women's hairdressers, metal workers, printing pressmen, textile workers, and cabinetmakers (Table 4). Printing pressmen, however, had very low numbers of cases and controls (<10) for all analyses except for CLL/SLL.

Attributable fraction. We estimated the proportion for NHL and for each subtype that was attributable to the main occupational groups (farmers, textile workers, hairdressers, wood workers, painters) or specific occupations (e.g., women's hairdressers, spray painters) for which

an elevated relative risk had been observed (p<0.05). AFs for NHL were low, between 0.3% for womens' hairdressers and 0.63% for general farm workers, and somewhat higher for the rarer individual subtypes, 1.49% for womens' hairdressers and CLL/SLL and up to 3.69% for the textile worker group and PTCL. AFs were different by gender in a number of occupations, reflecting the scarcity of men or women in a particular occupation.

Discussion

We found evidence that NHL was associated with employment as textile workers, hairdressers, and farm workers, as well as with painters, printers, wood workers, metal workers, medical workers, electrical workers and cleaners. The statistically significant heterogeneity in relative risk estimates among subtypes suggested that women's hairdressers were particularly associated with DLBCL and CLL/SLL and textile workers with DLBCL and PTCL .

Our pooled analysis used a uniform classification of NHL diagnosis and is substantially larger than any individual study. A limitation in our study is that grouping workers according to job title disregards the wide qualitative and quantitative variation in exposure that may occur within the same job title (McGuire et al. 1998). Even if an association between job title and disease is found, the potentially causative agents are unknown, though they likely are common rather than rare exposures within the occupational group. The international nature of this study also implies that only associations for occupations with internationally comparable exposure profiles can be detected, and that some misclassification will be introduced due to the recoding of different occupational classifications into one. An advantage of using job titles rather than specific exposures is that recall by participants is less likely influenced by their disease status, making differential misclassification also less likely. The multiple comparisons of a job title based approach, however, suggests a vulnerability to false positive findings. Results are therefore

focused on the selected *a priori* occupational groups (24 were eligible) extracted from earlier NHL research. We discuss below the findings from our study that are consistent with previously reported associations, and discuss occupational exposures that might be implicated as etiologic agents.

We confirmed the previously reported association between NHL and crop farming occupations (Keller-Byrne et al. 1997; Blair et al. 1992), but not animal farming (Boffetta and de Vocht 2007; Amadori et al. 1995; Lee et al. 2002), which was negatively associated with CLL/SLL. This suggests that risk estimates for all farming and all NHL combined may be uninformative and that future studies will need to consider both NHL subtype and farming type in order to identify the possible specific farming exposures that may be involved in these associations.

The observed associations with hairdressers was stronger for women's hairdressers, supporting an hypothesis of hair dye or other hair treatments more commonly used by women as a possible cause. Associations were present for DLBCL and CLL/SLL while absent for FL. A previous pooled analysis of Interlymph studies reported associations with personal hair dye use for NHL subtypes FL and CLL/SLL (Zhang et al. 2008). Exposure from personal hair dye use and that of hairdressers is however not strictly comparable since hairdressers are exposed daily to a range of other compounds such as solvents and propellant gases, including dichloromethane and chlorofluorocarbons.

The observed association for textile related occupations and NHL (DLBCL and PTCL) may suggest a range of possible exposures that can occur in this environment, but the implication of multiple specific occupations within this *a priori* group involved in fabric making as well as garment making indicates that associations were not restricted to specific tasks in the textile

industry (e.g. textile dyeing) but may be associated with more ubiquitous exposures (Siemiatycki et al. 1986).

We found associations with NHL for a number of other occupations potentially exposed to solvents. Among these occupations were cleaners, painters (especially spray painters) with potential for exposure to the solvents in paints and paint strippers, and machine tool operators who may be exposed to a range of solvents including aliphatic hydrocarbon solvents, aromatic hydrocarbon solvents, chlorinated solvents, mineral oils, and diesel. The metal workers would also be exposed to metal dust and metal working fluids. Although our positive findings for these occupations may support a role for solvent exposure as a risk factor for NHL, other exposures may also be responsible.

Some solvent exposure would likely be implicated in two other occupational groups for which we observed an association with NHL: several specific occupations within the electrical and electronics related group, which may also have exposure to electromagnetic fields (Mester 2006), and an association for carpenters who, in addition to solvents, may also be exposed to wood dust, wood preservatives, formaldehyde, and moulds. Forestry workers could also be exposed to wood dust, and potentially to pesticides and engine exhausts.

All teaching occupations combined was inversely associated with NHL, opposite to the results of a death certificate based case-control study (Figgs et al. 1995) and a meta-analysis (Baker et al. 1999). We did observe a marked positive association for ‘pre-primary education teachers’ and CLL/SLL, which could point towards common childhood infections as a possible causal factors (Vineis et al. 2000). Long term employment as a medical doctor, in which infectious agents may also play a role, was associated with FL.

Among the four NHL subtypes, the statistically significant heterogeneity in relative risk estimates suggested an increased risk for womens' hairdressers of DLBCL and CLL/SLL, but not FL as suggested previously for personal hair dye use (Zhang et al. 2008) (Sangrajrang et al. 2011). Textile workers were another occupational group to show heterogeneity across NHL subtypes, implicating DLBCL and PTCL. There was no significant heterogeneity in ORs for crop and mixed/unspecified farming among the four subtypes, although DLBCL and CLL/SLL appeared to be most strongly associated with farming occupations. We note the strong association between spray-painters and FL, and the lack of adequate numbers for analysis in the other subtypes examined. A recent major analysis of NHL subtypes and a broad range of risk factors in the Interlymph consortium reported that certain occupations were associated with one or more subtypes, including spray-painter (FL), crop farmers (DLBCL, CLL/SLL), hairdressers (DLBCL, CLL/SLL) and medical doctors (FL). These analyses were adjusted for all other significant risk factors (Morton et al. 2014) and consistent with our findings. However, our analysis based on occupational titles is not the proper setting to explore whether socio-economic confounders we were unable to control for might have generated some of our positive findings; such hypotheses need to specifically addressed in dedicated analyses.

Conclusions

This pooled analysis supports a role for textile, hairdressing, and farming related exposures in the development of NHL. Additional occupations associated with NHL or NHL subtypes include cleaners, painters, printers and wood workers. The results by gender indicate that occupational exposures may play a role in NHL for both women and men, but that the specific occupations involved differ between the genders. The large numbers of participants and application of standard NHL and occupational classification systems allowed estimates of relative risk by NHL

subtype which forms an important step towards improving our understanding of NHL aetiology. The study findings can be further refined at the next stage after specific exposures are pinpointed in detailed exposure studies.

References

Alavanja MC, Blair A, Masters MN. 1990. Cancer mortality in the U.S. flour industry. J Natl Cancer Inst 82(10): 840-848.

Amadori D, Nanni O, Falcini F, Saragoni A, Tison V, Callea A, et al. 1995. Chronic lymphocytic leukaemias and non-Hodgkin's lymphomas by histological type in farming-animal breeding workers: a population case-control study based on job titles. Occup Environ Med 52(6): 374-379.

Baker P, Inskip H, Coggon D. 1999. Lymphatic and hematopoietic cancer in teachers. Scand J Work Environ Health 25(1): 5-17.

Band PR, Le ND, Fang R, Gallagher R. 2004. Identification of occupational cancer risks in British Columbia: a population-based case-control study of 769 cases of non-Hodgkin's lymphoma analyzed by histopathology subtypes. J Occup Environ Med 46(5): 479-489.

Bernstein L, Allen M, Anton-Culver H, Deapen D, Horn-Ross PL, Peel D, et al. 2002. High breast cancer incidence rates among California teachers: results from the California Teachers Study (United States). Cancer Causes Control 13(7): 625-635.

Blair A, Hartge P, Stewart PA, McAdams M, Lubin J. 1998. Mortality and cancer incidence of aircraft maintenance workers exposed to trichloroethylene and other organic solvents and chemicals: extended follow up. Occup Environ Med 55(3): 161-171.

Blair A, Linos A, Stewart PA, Burmeister LF, Gibson R, Everett G, et al. 1993. Evaluation of risks for non-Hodgkin's lymphoma by occupation and industry exposures from a case-control study. Am J Ind Med 23(2): 301-312.

Blair A, Zahm SH, Pearce NE, Heineman EF, Fraumeni JF, Jr. 1992. Clues to cancer etiology from studies of farmers. Scand J Work Environ Health 18(4): 209-215.

Boffetta P, Andersen A, Lynge E, Barlow L, Pukkala E. 1994. Employment as hairdresser and risk of ovarian cancer and non-Hodgkin's lymphomas among women. J Occup Med 36(1): 61-65.

Boffetta P, de Vocht F. 2007. Occupation and the risk of non-hodgkin lymphoma. Cancer Epidemiol Biomarkers Prev 16(3): 369-372.

Cano MI, Pollan M. 2001. Non-Hodgkin's lymphomas and occupation in Sweden. Int Arch Occup Environ Health 74(6): 443-449.

Chia SE, Wong KY, Tai BC. 2012. Occupation and risk of non-Hodgkin's lymphoma in Singapore. Occup Med (Lond) 62(1): 29-33.

Chiu BC, Soni L, Gapstur SM, Fought AJ, Evens AM, Weisenburger DD. 2007. Obesity and risk of non-Hodgkin lymphoma (United States). Cancer Causes Control 18(6): 677-685.

Cocco P, t'Mannetje A, Fadda D, Melis M, Becker N, de Sanjose S, et al. 2010. Occupational exposure to solvents and risk of lymphoma subtypes: results from the Epilymph case-control study. Occup Environ Med 67(5): 341-347.

Costantini AS, Miligi L, Vineis P. 1998. [An Italian multicenter case-control study on malignant neoplasms of the hematolymphopoietic system. Hypothesis and preliminary results on work-related risks. WILL (Working Group on Hematolymphopoietic Malignancies in Italy)]. Med Lav 89(2): 164-176.

De Roos AJ, Hartge P, Lubin JH, Colt JS, Davis S, Cerhan JR, et al. 2005. Persistent organochlorine chemicals in plasma and risk of non-Hodgkin's lymphoma. Cancer Res 65(23): 11214-11226.

Delzell E, Grufferman S. 1983. Cancer and other causes of death among female textile workers, 1976-78. J Natl Cancer Inst 71(4): 735-740.

Dryver E, Brandt L, Kauppinen T, Olsson H. 2004. Occupational exposures and non-Hodgkin's lymphoma in Southern Sweden. Int J Occup Environ Health 10(1): 13-21.

Eriksson M, Hardell L, Malker H, Weiner J. 1992. Malignant lymphoproliferative diseases in occupations with potential exposure to phenoxyacetic acids or dioxins: a register-based study. Am J Ind Med 22(3): 305-312.

Fabbro-Peray P, Daures JP, Rossi JF. 2001. Environmental risk factors for non-Hodgkin's lymphoma: a population-based case-control study in Languedoc-Roussillon, France. Cancer Causes Control 12(3): 201-212.

Figgs LW, Dosemeci M, Blair A. 1995. United States non-Hodgkin's lymphoma surveillance by occupation 1984-1989: a twenty-four state death certificate study. Am J Ind Med 27(6): 817-835.

Franceschi S, Serraino D, Bidoli E, Talamini R, Tirelli U, Carbone A, et al. 1989. The epidemiology of non-Hodgkin's lymphoma in the north-east of Italy: a hospital-based case-control study. Leuk Res 13(6): 465-472.

Fritschi L, Benke G, Hughes AM, Kricker A, Vajdic CM, Grulich A, et al. 2005. Risk of non-Hodgkin lymphoma associated with occupational exposure to solvents, metals, organic dusts and PCBs (Australia). Cancer Causes Control 16(5): 599-607.

Fritschi L, Siemiatycki J. 1996. Lymphoma, myeloma and occupation: results of a case-control study. Int J Cancer 67(4): 498-503.

Fu H, Demers PA, Costantini AS, Winter P, Colin D, Kogevinas M, et al. 1996. Cancer mortality among shoe manufacturing workers: an analysis of two cohorts. Occup Environ Med 53(6): 394-398.

Gallagher RP, Threlfall WJ, Band PR, Spinelli JJ. 1985. Cancer mortality experience of woodworkers, loggers, fishermen, farmers, and miners in British Columbia. Natl Cancer Inst Monogr 69: 163-167.

Hayes RB, Blair A, Stewart PA, Herrick RF, Mahar H. 1990. Mortality of U.S. embalmers and funeral directors. Am J Ind Med 18(6): 641-652.

Higgins JP, Thompson SG. 2002. Quantifying heterogeneity in a meta-analysis. Stat Med 21(11): 1539-1558.

Holly EA, Lele C. 1997. Non-Hodgkin's lymphoma in HIV-positive and HIV-negative homosexual men in the San Francisco Bay Area: allergies, prior medication use, and sexual practices. J Acquir Immune Defic Syndr Hum Retrovirol 15(3): 211-222.

Hunting KL, Longbottom H, Kalavar SS, Stern F, Schwartz E, Welch LS. 1995. Haematopoietic cancer mortality among vehicle mechanics. Occup Environ Med 52(10): 673-678.

ILO International Labour Office. 1981. International Standard Classification of Occupations. Revised Edition 1968. Geneva: ILO.

Ji J, Hemminki K. 2006. Socioeconomic/occupational risk factors for lymphoproliferative diseases in Sweden. Ann Epidemiol 16(5): 370-376.

Keller-Byrne JE, Khuder SA, Schaub EA, McAfee O. 1997. A meta-analysis of non-Hodgkin's lymphoma among farmers in the central United States. Am J Ind Med 31(4): 442-444.

Keller-Byrne JE, Khuder SA, Schaub EA. 1995. Meta-analysis of leukemia and farming. Environ Res 71(1): 1-10.

Khuder SA, Schaub EA, Keller-Byrne JE. 1998. Meta-analyses of non-Hodgkin's lymphoma and farming. Scand J Work Environ Health 24(4): 255-261.

Lahti TA, Partonen T, Kyyronen P, Kauppinen T, Pukkala E. 2008. Night-time work predisposes to non-Hodgkin lymphoma. Int J Cancer 123(9): 2148-2151.

Last JM, Abramson JH, International Epidemiological Association. 1995. A dictionary of epidemiology. 3rd ed. New York: Oxford University Press.

Lee E, Burnett CA, Lalich N, Cameron LL, Sestito JP. 2002. Proportionate mortality of crop and livestock farmers in the United States, 1984-1993. Am J Ind Med 42(5): 410-420.

Li FP, Fraumeni JF, Jr., Mantel N, Miller RW. 1969. Cancer mortality among chemists. J Natl Cancer Inst 43(5): 1159-1164.

Linet MS, Malker HS, McLaughlin JK, Weiner JA, Blot WJ, Ericsson JL, et al. 1993. non-Hodgkin's lymphoma and occupation in Sweden: a registry based analysis. Br J Ind Med 50(1): 79-84.

Linos A, Blair A, Cantor KP, Burmeister L, VanLier S, Gibson RW, et al. 1990. Leukemia and non-Hodgkin's lymphoma among embalmers and funeral directors. J Natl Cancer Inst 82(1): 66.

Lynge E, Andersen A, Rylander L, Tinnerberg H, Lindbohm ML, Pukkala E, et al. 2006. Cancer in persons working in dry cleaning in the Nordic countries. Environ Health Perspect 114(2): 213-219.

Ma F, Lee DJ, Fleming LE, Dosemeci M. 1998. Race-specific cancer mortality in US firefighters: 1984-1993. J Occup Environ Med 40(12): 1134-1138.

Mao Y, Hu J, Ugnat AM, White K. 2000. Non-Hodgkin's lymphoma and occupational exposure to chemicals in Canada. Canadian Cancer Registries Epidemiology Research Group. Ann Oncol 11 Suppl 1: 69-73.

McGuire V, Nelson LM, Koepsell TD, Checkoway H, Longstreth WT, Jr. 1998. Assessment of occupational exposures in community-based case-control studies. Annu Rev Public Health 19: 35-53.

McLean D, Cheng S, t Mannetje A, Woodward A, Pearce N. 2004. Mortality and cancer incidence in New Zealand meat workers. Occup Environ Med 61(6): 541-547.

Mester B, Nieters A, Deeg E, Elsner G, Becker N, Seidler A. 2006. Occupation and malignant lymphoma: a population based case control study in Germany. Occup Environ Med 63(1): 17-26.

Metayer C, Johnson ES, Rice JC. 1998. Nested case-control study of tumors of the hemopoietic and lymphatic systems among workers in the meat industry. Am J Epidemiol 147(8): 727-738.

Miligi L, Seniori Costantini A, Crosignani P, Fontana A, Masala G, Nanni O, et al. 1999. Occupational, environmental, and life-style factors associated with the risk of hematolymphopoietic malignancies in women. Am J Ind Med 36(1): 60-69.

Miller BA, Blair AE, Raynor HL, Stewart PA, Zahm SH, Fraumeni JF, Jr. 1989. Cancer and other mortality patterns among United States furniture workers. Br J Ind Med 46(8): 508-515.

Morton LM, Slager SL, Cerhan JR, Wang SS, Vajdic CM, Skibola CF, et al. 2014. Etiologic Heterogeneity Among Non-Hodgkin Lymphoma Subtypes: The InterLymph Non-Hodgkin Lymphoma Subtypes Project. J Natl Cancer Inst Monogr 2014(48): 130-144.

Morton LM, Turner JJ, Cerhan JR, Linet MS, Treseler PA, Clarke CA, et al. 2007. Proposed classification of lymphoid neoplasms for epidemiologic research from the Pathology

Working Group of the International Lymphoma Epidemiology Consortium (InterLymph). Blood 110(2): 695-708.

Neasham D, Sifi A, Nielsen KR, Overvad K, Raaschou-Nielsen O, Tjonneland A, et al. 2011. Occupation and risk of lymphoma: a multicentre prospective cohort study (EPIC). Occup Environ Med 68(1): 77-81.

Olin GR, Ahlbom A. 1980. The cancer mortality among Swedish chemists graduated during three decades. A comparison with the general population and with a cohort of architects. Environ Res 22(1): 154-161.

Orsi L, Delabre L, Monnereau A, Delval P, Berthou C, Fenaux P, et al. 2009. Occupational exposure to pesticides and lymphoid neoplasms among men: results of a French case-control study. Occup Environ Med 66(5): 291-298.

Ott MG, Teta MJ, Greenberg HL. 1989. Lymphatic and hematopoietic tissue cancer in a chemical manufacturing environment. Am J Ind Med 16(6): 631-643.

Pearce NE, Sheppard RA, Smith AH, Teague CA. 1987. Non-Hodgkin's lymphoma and farming: an expanded case-control study. Int J Cancer 39(2): 155-161.

Persson B, Dahlander AM, Fredriksson M, Brage HN, Ohlson CG, Axelson O. 1989. Malignant lymphomas and occupational exposures. Br J Ind Med 46(8): 516-520.

Persson B, Fredrikson M. 1999. Some risk factors for non-Hodgkin's lymphoma. Int J Occup Med Environ Health 12(2): 135-142.

Persson B, Fredriksson M, Olsen K, Boeryd B, Axelson O. 1993. Some occupational exposures as risk factors for malignant lymphomas. Cancer 72(5): 1773-1778.

Rafnsson V. 2001. Incidence of cancer among bookbinders, printers, photoengravers, and typesetters. Occup Environ Med 58(8): 523-527.

Reif J, Pearce N, Kawachi I, Fraser J. 1989. Soft-tissue sarcoma, non-Hodgkin's lymphoma and other cancers in New Zealand forestry workers. Int J Cancer 43(1): 49-54.

Rinsky RA, Ott G, Ward E, Greenberg H, Halperin W, Leet T. 1988. Study of mortality among chemical workers in the Kanawha Valley of West Virginia. Am J Ind Med 13(4): 429-438.

Rosenman KD, Reilly MJ. 2004. Cancer mortality and incidence among a cohort of benzidine and dichlorobenzidine dye manufacturing workers. Am J Ind Med 46(5): 505-512.

Sama SR, Martin TR, Davis LK, Kriebel D. 1990. Cancer incidence among Massachusetts firefighters, 1982-1986. Am J Ind Med 18(1): 47-54.

Sangrajrang S, Renard H, Kuhaprema T, Pornsopone P, Arpornwirat W, Brennan P. 2011. Personal use of hair dyes--increased risk of non-Hodgkin's lymphoma in Thailand. Asian Pac J Cancer Prev 12(9): 2393-2396.

Schenk M, Purdue MP, Colt JS, Hartge P, Blair A, Stewart P, et al. 2009. Occupation/industry and risk of non-Hodgkin's lymphoma in the United States. Occup Environ Med 66(1): 23-31.

Scherr PA, Hutchison GB, Neiman RS. 1992. Non-Hodgkin's lymphoma and occupational exposure. Cancer Res 52(19 Suppl): 5503s-5509s.

Schottenfeld D, Fraumeni JF. 2006. Cancer epidemiology and prevention. 3rd ed. Oxford ; New York: Oxford University Press.

Schumacher MC, Delzell E. 1988. A death-certificate case-control study of non-Hodgkin's lymphoma and occupation in men in North Carolina. Am J Ind Med 13(3): 317-330.

Seniori Costantini A, Miligi L, Kriebel D, Ramazzotti V, Rodella S, Scarpi E, et al. 2001. A multicenter case-control study in Italy on hematolymphopoietic neoplasms and occupation. Epidemiology 12(1): 78-87.

Siemiatycki J, Richardson L, Gerin M, Goldberg M, Dewar R, Desy M, et al. 1986. Associations between several sites of cancer and nine organic dusts: results from an hypothesis-generating case-control study in Montreal, 1979-1983. Am J Epidemiol 123(2): 235-249.

Skov T, Lynge E. 1991. Non-Hodgkin's lymphoma and occupation in Denmark. Scand J Soc Med 19(3): 162-169.

Spinelli JJ, Ng CH, Weber JP, Connors JM, Gascoyne RD, Lai AS, et al. 2007. Organochlorines and risk of non-Hodgkin lymphoma. Int J Cancer 121(12): 2767-2775.

t Mannetje A, Dryson E, Walls C, McLean D, McKenzie F, Maule M, et al. 2008. High risk occupations for non-Hodgkin's lymphoma in New Zealand: case-control study. Occup Environ Med 65(5): 354-363.

Tatham L, Tolbert P, Kjeldsberg C. 1997. Occupational risk factors for subgroups of non-Hodgkin's lymphoma. Epidemiology 8(5): 551-558.

Thomas TL, Waxweiler RJ, Moure-Eraso R, Itaya S, Fraumeni JF, Jr. 1982. Mortality patterns among workers in three Texas oil refineries. J Occup Med 24(2): 135-141.

Tranah GJ, Holly EA, Bracci PM. 2009. Solvent exposure and non-Hodgkin lymphoma: no risk in a population-based study in the San Francisco Bay Area. Cancer Epidemiol Biomarkers Prev 18(11): 3130-3132.

Villeneuve PJ, Agnew DA, Miller AB, Corey PN. 2000. Non-Hodgkin's lymphoma among electric utility workers in Ontario: the evaluation of alternate indices of exposure to 60 Hz electric and magnetic fields. Occup Environ Med 57(4): 249-257.

Vineis P, Miligi L, Crosignani P, Fontana A, Masala G, Nanni O, et al. 2000. Delayed infection, family size and malignant lymphomas. J Epidemiol Community Health 54(12): 907-911.

Willett EV, Smith AG, Dovey GJ, Morgan GJ, Parker J, Roman E. 2004. Tobacco and alcohol consumption and the risk of non-Hodgkin lymphoma. Cancer Causes Control 15(8): 771-780.

Wong O, Morgan RW, Bailey WJ, Swencicki RE, Claxton K, Kheifets L. 1986. An epidemiological study of petroleum refinery employees. Br J Ind Med 43(1): 6-17.

Woods JS, Polissar L, Severson RK, Heuser LS, Kulander BG. 1987. Soft tissue sarcoma and non-Hodgkin's lymphoma in relation to phenoxyherbicide and chlorinated phenol exposure in western Washington. J Natl Cancer Inst 78(5): 899-910.

Zhang Y, Holford TR, Leaderer B, Boyle P, Zahm SH, Flynn S, et al. 2004. Hair-coloring product use and risk of non-Hodgkin's lymphoma: a population-based case-control study in Connecticut. Am J Epidemiol 159(2): 148-154.

Zhang Y, Sanjose SD, Bracci PM, Morton LM, Wang R, Brennan P, et al. 2008. Personal use of hair dye and the risk of certain subtypes of non-Hodgkin lymphoma. Am J Epidemiol 167(11): 1321-1331.

Zheng T, Blair A, Zhang Y, Weisenburger DD, Zahm SH. 2002. Occupation and risk of non-Hodgkin's lymphoma and chronic lymphocytic leukemia. J Occup Environ Med 44(5): 469-474.

Table 1. Description of the study population

Study acronym	Country (study center)	Year of Diagnosis	Age range	Cases (n)	Controls (n)	Source of controls	Reference[b]
BC[a]	Canada (Vancouver; Victoria)	2000-2004	20-80	821	848	Random selection from Client Registry of the Ministry of health, frequency matched by age, sex, region	(Spinelli et al. 2007)
Nebraska[a]	USA (Nebraska)	1999-2002	20-75	386	533	Random digit dialling, frequency matched by age and sex	(Chiu et al. 2007)
NCI-SEER	USA (Detroit; Iowa; Los Angeles; Seattle)	1998-2001	20-74	1,321	1,057	<65 years random digit dialling; 65+ years random selection from Centers for Medicare and Medicaid Services, stratified by study area, age, sex, race	(De Roos et al. 2005)
UCSF1	USA (San Francisco)	1988-1995	21-74	1,260	2,094	Random digit dialling, frequency matched by age, sex, and county of residence	(Tranah et al. 2009)
Yale	USA (Connecticut)	1995-2001	23-85	600	717	Women only: <65 years random digit dialling; 65+ years random selection from Centers for Medicare and Medicaid Services. Frequency Matched ±5 years of age	(Zhang et al. 2004)
UK	UK (Lancashire/ South Lakeland; Yorkshire; parts of South West England)	1998- 2003	18-69	827	1,129	Individually matched by age, sex, region of residence from general practice lists	(Willett et al. 2004)
Epilymph	Spain; France; Germany; Italy; Ireland; Czech Republic	1998-2004	18-89	1,660	2,460	Spain/France/Ireland: hospital controls matched by age (±5 years), sex and study region; Germany: random selection from population register, individually matched by sex, age and study region	(Cocco et al. 2010)
Italy	Italy (12 areas)	1991-1993	19-79	1,910	1,771	Random sample of the population resident in the area, stratified by 5 year age groups and sex. Fortli/Ragusa/Firenze: computerized demographics files. Other areas: National Health Service files	(Seniori Costantini et al. 2001)
ENGELA	France (Bordeaux; Brest; Caen; Nantes; Lille; Toulouse)	2000-2004	20-75	567	722	Hospital controls, mainly in orthopaedic and rheumatological departments and residing in the hospital's catchment area, individually matched with the cases by centre, age (±3 years) and sex	(Orsi et al. 2009)
NSW	Australia (New South Wales; Australian Capital Territory)	2000-2001	20-74	694	694	Random selection from electoral register; frequency matched by age, sex, state or territory	(Fritschi et al. 2005)
Total				10,046	12,025		
men				5,265	6,228		
women				4,781	5,797		

[a]Only the longest held occupation was recorded for BC and Nebraska. All other studies recorded a complete occupational history.
[b]One reference is given for each study, usually the publication with study results for occupation or occupational exposures.

Table 2. Occupational groups of *a priori* interest.

Occupational group (study references reporting an increased lymphoid cancer risk)	ISCO 68 codes included in the group	Exposures hypothesised to be related to increased risk
bakers/millers (Alavanja et al. 1990; Blair et al. 1993)	**771**-grain millers and related workers; **776**-bakers, pastrycooks and confectionery makers (excl 77650 chocolate maker & 77660 confectionery maker)	flour dust, pesticides
chemical workers (Li et al. 1969; Olin and Ahlbom 1980; Rinsky et al. 1988; Ott et al. 1989; Franceschi et al. 1989; Figgs et al. 1995; Rosenman and Reilly 2004; Ji and Hemminki 2006; Neasham et al. 2011)	**011-**chemists; **02510** chemical engineer (general); **02590** other chemical engineers; **03610**-chemical engineering technician (general); **70040**-supervisor and general foreman, chemical and related materials processing; **74**-chemical processers and related workers (excl 745-petroleum-refining workers)	range of chemicals, benzidine, dyes
cleaners (Blair et al. 1993; t Mannetje et al. 2008; Mester et al. 2006)	**55**-building caretakers, charworkers, cleaners and related workers; **95975**-building exterior cleaner	cleaning products
drivers (t Mannetje et al. 2008; Linet et al. 1993; Holly and Lele 1997; Cano and Pollan 2001; Band et al. 2004)	**974**-earth-moving and related machinery operators (excl 97470-concrete-mixer operator&97475-concrete-mixing-plant operator); **979**-material handling equipment operators nec; **983**-railway engine-drivers and firemen; **985**-motor-vehicle drivers	engine exhausts, solvents
dry-cleaners & laundry (Blair et al. 1993; Ji and Hemminki 2006; Cano and Pollan 2001; Lynge et al. 2006; Schenk et al. 2009)	**56**-launderers, dry-cleaners and pressers	solvents (e.g. tetrachloroethylene)
electrical & electronics workers (Figgs et al. 1995; Mester et al. 2006; Linet et al. 1993; Band et al. 2004; Villeneuve et al. 2000)	**023**-electrical and electronics engineers; **034**-electrical and electronics engineering technicians; **70055**-supervisor and general foreman, manufacturing and installation of electrical and electronic equipment; **85**-electrical fitters and related electrical and electronics workers	EMF, solvents, PCBs
engine mechanics (Figgs et al. 1995; Neasham et al. 2011; Hunting et al. 1995; Blair et al. 1998; Zheng et al. 2002; Dryver et al. 2004)	**03520**-mechanical engineering technician (motors and engines); **843**-motor-vehicle mechanics; **844**-aircraft engine mechanics	solvents (in particular petrol containing benzene)
farmers meta-analyses:(Keller-Byrne et al. 1997 ; Blair et al. 1992; Keller-Byrne et al. 1995; Khuder et al. 1998)	**60**-farm managers and supervisors; **61**-farmers; **62**-agricultural and animal husbandry workers	pesticides; infectious agents from farm animals; engine exhausts; solvents; paints, welding fumes
farmers-animal	**61240**-livestock farmer; **61250**-dairy farmer; **61260**-poultry farmer; **624**-livestock workers; **625**-dairy farm workers; **626**-poultry farm workers	
farmers-crop	**61220**-field crop farmer; **61230**-orchard, vineyard and related tree and shrub crop farmer; **61270**-horticultural farmer; **622**-field crop an vegetable farm workers; **623**-orchard, vineyard and related tree and shrub crop workers; **627**-nursery workers and gardeners; **62940**-tree tapper (except rubber)	
farmers- mixed/unspecified	**60020**-farm manager; **60030**-farm supervisor; **611**-general farmers; **61290**-other specialised farmers; **621**-general farm workers; **628**-farm machinery operators; **62920**-apiary worker; **62930**-sericulture worker; **62950**-irrigator; **62960**-groundsman; **62990**-other agricultural and animal husbandry workers	
fire fighters (Figgs et al. 1995; Band et al. 2004; Sama et al. 1990; Ma et al. 1998)	**581**-fire fighters	combustion products, benzene, dioxins. chemical releases

forestry workers (Blair et al. 1993; Band et al. 2004; Zheng et al. 2002; Woods et al. 1987; Reif et al. 1989)	**63**-forestry workers	pesticides (herbicides), engine exhausts
hair dressers (Blair et al. 1993; Persson et al. 1989; Boffetta et al. 1994; Costantini et al. 1998; Miligi et al. 1999)	**57**-hairdressers, barbers, beauticians and related workers	hair dyes, formaldehyde, solvents, ammonia
leather workers (Ji and Hemminki 2006; Neasham et al. 2011; Mester et al. 2006; Linet et al. 1993; Schenk et al. 2009; Fu et al. 1996)	**76**-tanners, fellmongers and pelt dressers; **79460**-leather garment cutter; **79480**-leather glove cutter; **79530**-leather garment hand sewer; **80**-shoemakers and leather goods makers	solvents, tannins, formaldehyde, chromium
meat workers (Neasham et al. 2011; Pearce et al. 1987; Tatham et al. 1997; Metayer et al. 1998; McLean et al. 2004)	**773**-butchers and meat preparers; **77460**-meat and fish smoker	infectious agents
medical workers (Figgs et al. 1995; Ji and Hemminki 2006; Mester et al. 2006; Schenk et al. 2009; Miligi et al. 1999; Skov and Lynge 1991; Eriksson et al. 1992;)Lahti et al. 2008)	**05260**-medical pathologist; **05430**-medical science technician; **06/07**- medical, dental, veterinary and related workers	solvents, antineoplastic drugs, night-shifts, ionizing- and non-ionizing radiation, sterilizing agents, infectious agents
metal processers (Mester et al. 2006; Cano and Pollan 2001; Band et al. 2004)	**70030**-supervisor and general foreman, metal processing; **72**-metal processers	metals, metal fumes
metal workers (Seniori Costantini et al. 2001; Blair et al. 1993; t Mannetje et al. 2008; Cano and Pollan 2001; Zheng et al. 2002; Skov and Lynge 1991)	**70050**-supervisor and general foreman, manufacturing of machinery and metal products; **83**-blacksmiths, toolmakers and machine tool operators; **84135**-metalworking machine-tool fitter-assembler; **873**-sheet-metal workers; **874**-structural metal preparers and erectors	solvents, metals, cutting- lubricating and mineral oils
painters (t Mannetje et al. 2008; Band et al. 2004; Dryver et al. 2004; Schumacher and Delzell 1988; Scherr et al. 1992; Persson and Fredrikson 1999)	**16130**-painter, artist; **16160**-painter restorer; **895**-glass ceramics painters and decorators; **93**-painters	paint, solvents, paint strippers, dusts
petroleum workers (Franceschi et al. 1989; Thomas et al. 1982; Wong et al. 1986)	**02520** -chemical engineer (petroleum); **02740**-petroleum and natural gas engineer; **03620**-chemical engineering technician (petroleum); **03820**-petroleum and natural gas extraction technician; **713**-well drillers, borers and related workers (excl 71380-well driller and borer except oil and gas wells&71390- other well drillers, borers and related workers); **74350**-crude oil treater (oilfield); **745**-petroleum-refining workers	solvents, in particular benzene, petrol
printers (Boffetta and de Vocht 2007; Blair et al. 1993; Band et al. 2004; Zheng et al. 2002; Dryver et al. 2004; Rafnsson 2001)	**03280**-lithographic artist; **84145**- printing machinery fitter-assembler; **84940**-printing machinery mechanic; **92**-printers and related workers	solvents, inks, lead
pulp&paper workers (Neasham et al. 2011; Band et al. 2004)	**733**-paper pulp preparers; **734**-paper makers	dioxins

teachers (Boffetta and de Vocht 2007; Figgs et al. 1995; Linet et al. 1993; Zheng et al. 2002; Dryver et al. 2004; Miligi et al. 1999; Bernstein et al. 2002; Baker et al. 1999; Chia et al. 2012)	**13**-teachers	infectious agents
textile workers (Blair et al. 1993; Cano and Pollan 2001; Miligi et al. 1999; Schumacher and Delzell 1988; Delzell and Grufferman 1983; Fritschi and Siemiatycki 1996)	**70070**-supervisor and general foreman, production of textiles and clothing manufacturing; **75**-spinners, weavers, knitters, dyers and related workers; **79**-tailors, dressmakers, sewers, upholsterers and related workers (excl 79460-leather garment cutter&79480-leather glove cutter); **84150**-textile machinery fitter-assembler; **84945**-textile machinery mechanic	solvents, dyes, EMF, formaldehyde
undertakers (Blair et al. 1993; Hayes et al. 1990; Linos et al. 1990)	**592**-undertakers and embalmers	formaldehyde
welders (Band et al. 2004; Zheng et al. 2002; Dryver et al. 2004; Costantini et al. 1998; Persson et al. 1993; Fabbro-Peray et al. 2001)	**872**-welders and flame-cutters	solvents, welding fumes, metal fumes, EMF
wood workers (Boffetta and de Vocht 2007; Linet et al. 1993; Band et al. 2004; Persson et al. 1989; Eriksson et al. 1992; Persson and Fredrikson 1999; Gallagher et al. 1985; Miller et al. 1989; Mao et al. 2000)	**71160**-underground timberman; **731**-wood treaters; **732**-sawyers, plywood makers and related wood-processing workers; **81**-cabinetmakers and related woodworkers; **954**-carpenters, joiners and parquetry workers	wood dust, solvents

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Table 3. Adjusted ORs (95%CI) for NHL by occupational title in 24 occupational groups.

			All NHL (n=10,046)					
			Ever employed			>10 years employment		
occupational group[b] and occupational title[c]	case	control	Male & female OR[a] (95% CI)	Male OR[a] (95% CI)	Female OR[a] (95% CI)	Male & female OR[a] (95% CI)	Male OR[a] (95% CI)	Female OR[a] (95% CI)
bakers/millers	131	158	0.95 (0.75,1.20)	1.00 (0.75,1.35)	0.83 (0.55,1.24)	0.90 (0.60,1.33)	0.95 (0.60,1.49)	–
chemical workers	127	167	0.96 (0.76,1.21)	0.98 (0.76,1.28)	0.93 (0.53,1.61)	1.00 (0.68,1.47)	1.06 (0.70,1.59)	–
cleaners	534	589	1.11 (0.98,1.25)	1.13 (0.92,1.38)	1.12 (0.95,1.31)	1.03 (0.84,1.27)	1.24 (0.85,1.82)	0.99 (0.77,1.27)
552 charworkers, cleaners and related	377	395	1.17 (1.01,1.36)	1.26 (0.91,1.75)	1.15 (0.97,1.36)	1.05 (0.83,1.34)	1.37 (0.75,2.49)	1.02 (0.79,1.33)
drivers	787	900	1.03 (0.93,1.14)	1.06 (0.95,1.19)	0.77 (0.53,1.13)	1.00 (0.85,1.17)	1.03 (0.87,1.21)	–
983 railway engine-drivers and firemen	10	27	0.45 (0.22,0.94)	0.45 (0.22,0.94)	na	–	–	–
98590 other motor-vehicle drivers	56	98	0.65 (0.46,0.92)	0.72 (0.50-1.02)	–	0.53 (0.29,0.96)	0.57 (0.31,1.06)	–
dry-cleaners	97	125	0.92 (0.70,1.20)	0.97 (0.56,1.69)	0.90 (0.66,1.23)	1.29 (0.74,2.23)	–	1.36 (0.72,2.55)
electrical&electronic	632	749	1.05 (0.94,1.18)	1.08 (0.95,1.23)	1.01 (0.79,1.29)	1.12 (0.95,1.32)	1.09 (0.92,1.30)	1.47 (0.90,2.41)
85 electrical fitters & related electrical/electronics workers	525	589	1.10 (0.98,1.25)	1.15 (0.99,1.32)	1.01 (0.78,1.30)	1.24 (1.02,1.50)	1.18 (0.96,1.45)	1.66 (0.99,2.77)
853 electrical & electronic equipment assemblers	121	145	1.07 (0.84,1.37)	0.98 (0.61,1.57)	1.08 (0.81,1.44)	1.86 (1.10,3.12)	–	1.88 (1.05,3.36)
85390 other electrical & electronic equipment assemblers	79	91	1.15 (0.84,1.57)	–	1.25 (0.89,1.76)	2.18 (1.09,4.38)	na	2.28 (1.12,4.64)
855 electrical wiremen	177	178	1.24 (1.00,1.54)	1.28 (1.03,1.58)	–	1.15 (0.83,1.59)	1.14 (0.82,1.58)	–
85540 vehicle electrician	20	10	2.58 (1.20,5.55)	2.60 (1.20,5.59)	na	–	–	na
engine mechanics	303	382	0.99 (0.84,1.16)	1.00 (0.85,1.17)	–	1.06 (0.77,1.46)	1.08 (0.79,1.49)	na
farmers-any	1372	1433	1.03 (0.95,1.13)	1.02 (0.92,1.14)	1.03 (0.89,1.19)	1.06 (0.95,1.19)	1.04 (0.90-1.21)	1.06 (0.88-1.29)
farmers-animal	264	316	0.86 (0.72,1.02)	0.82 (0.66,1.00)	0.90 (0.65,1.23)	0.92 (0.72,1.18)	0.84 (0.62,1.14)	1.03 (0.66,1.60)
farmers-crop	582	573	1.10 (0.97,1.24)	1.12 (0.96,1.31)	1.04 (0.84,1.28)	1.18 (1.00,1.41)	1.25 (1.00,1.57)	1.05 (0.79,1.38)
622 field crop & vegetable farm workers	276	233	1.26 (1.05,1.51)	1.21 (0.95,1.56)	1.29 (0.98,1.69)	1.25 (0.96,1.62)	1.18 (0.83,1.67)	1.33 (0.90,1.95)
62210 field crop farm worker (general)	149	118	1.38 (1.07,1.77)	1.32 (0.95,1.83)	1.42 (0.95,2.12)	1.29 (0.91,1.82)	1.23 (0.80,1.90)	1.34 (0.75,2.40)
farmers-mix&unspecified	716	698	1.07 (0.95,1.20)	1.03 (0.90,1.19)	1.13 (0.92,1.38)	1.08 (0.93,1.26)	1.00 (0.82,1.21)	1.23 (0.94,1.61)
621 general farm workers	437	404	1.19 (1.03,1.37)	1.22 (1.02,1.46)	1.12 (0.87,1.43)	1.19 (0.95,1.50)	1.07 (0.79,1.46)	1.36 (0.95,1.95)
fire fighters	49	79	0.76 (0.53,1.09)	0.72 (0.49,1.04)	na	0.50 (0.27,0.93)	0.50 (0.27,0.92)	na
forestry workers	66	71	1.05 (0.75,1.48)	1.06 (0.74,1.52)	–	2.25 (1.18,4.32)	2.40 (1.23,4.69)	na

hairdressers	154	158	1.21 (0.96,1.52)	0.89 (0.55,1.44)	1.28 (0.99,1.65)	1.27 (0.88,1.82)	1.20 (0.59,2.45)	1.26 (0.83,1.92)
57020 women's hairdresser	115	113	1.34 (1.02,1.74)	–	1.43 (1.08,1.89)	1.30 (0.84,2.01)	–	1.39 (0.88,2.19)
leather workers	132	156	0.93 (0.73,1.18)	0.90 (0.64,1.26)	0.97 (0.70,1.36)	0.87 (0.58,1.30)	0.76 (0.44,1.32)	1.04 (0.57,1.87)
meat workers	102	108	1.08 (0.81,1.42)	1.22 (0.89,1.68)	0.74 (0.41,1.33)	1.09 (0.70,1.68)	1.16 (0.70,1.90)	–
medical workers	681	895	0.96 (0.86,1.07)	1.08 (0.88,1.32)	0.91 (0.80,1.03)	1.11 (0.96,1.29)	1.32 (0.99,1.77)	1.03 (0.87,1.23)
061 medical doctors	77	82	1.16 (0.84,1.60)	1.06 (0.73,1.55)	1.55 (0.83,2.90)	1.87 (1.23,2.85)	1.73 (1.07,2.80)	–
062 medical assistants	58	112	0.69 (0.50,0.95)	0.69 (0.39,1.24)	0.69 (0.46,1.02)	0.85 (0.38,1.87)	–	0.90 (0.38,2.11)
metal processers	133	132	1.13 (0.88,1.45)	1.18 (0.90,1.54)	0.84 (0.41,1.71)	0.92 (0.60,1.40)	0.90 (0.58,1.40)	–
metal workers	616	732	0.99 (0.88,1.11)	1.04 (0.91,1.17)	0.78 (0.57,1.05)	0.96 (0.80,1.15)	0.97 (0.80,1.17)	0.84 (0.47,1.49)
83220 tool and die maker	34	46	0.81 (0.52,1.28)	0.83 (0.52,1.31)	–	0.48 (0.23,1.00)	0.50 (0.24,1.04)	–
834 machine-tool operators	208	228	1.09 (0.90,1.33)	1.13 (0.91,1.41)	0.93 (0.58,1.49)	1.55 (1.11,2.17)	1.65 (1.14,2.37)	–
painters	206	221	1.15 (0.94,1.39)	1.17 (0.94,1.44)	1.06 (0.64,1.78)	1.19 (0.87,1.63)	1.21 (0.87,1.68)	0.99 (0.33,2.99)
93930 spray-painter (except construction)	49	29	2.07 (1.30,3.29)	2.46 (1.45,4.15)	–	–	–	na
petroleum workers	12	18	0.79 (0.38,1.67)	0.80 (0.38,1.69)	na	–	–	na
printers	175	230	0.95 (0.78,1.17)	0.96 (0.75,1.24)	0.95 (0.68,1.33)	1.13 (0.80,1.60)	1.11 (0.75,1.63)	1.24 (0.56,2.73)
pulp&paper workers	16	24	0.79 (0.42,1.50)	1.17 (0.55,2.47)	0.24 (0.05,1.13)	–	–	na
teachers	871	1201	0.89 (0.81,0.98)	0.88 (0.76,1.03)	0.88 (0.78,0.99)	0.90 (0.79,1.03)	0.94 (0.76,1.17)	0.87 (0.74,1.04)
131 university and higher education teachers	189	274	0.75 (0.61,0.90)	0.75 (0.57,0.97)	0.76 (0.57,1.01)	0.86 (0.65,1.13)	0.97 (0.67,1.40)	0.73 (0.48,1.13)
132 secondary education teachers	223	344	0.82 (0.69-0.98)	0.91 (0.70,1.18)	0.75 (0.59,0.95)	0.81 (0.65,1.03)	1.03 (0.73,1.45)	0.67 (0.49,0.92)
13940 head teacher	29	15	2.16 (1.15,4.06)	2.19 (1.02,4.71)	–	–	–	–
13990 other teachers	32	56	0.63 (0.40,0.98)	0.49 (0.24,1.02)	0.73 (0.42,1.28)	–	–	–
textile workers	728	773	1.07 (0.96,1.20)	1.07 (0.86,1.33)	1.08 (0.95,1.24)	1.16 (0.98,1.36)	1.05 (0.76,1.43)	1.23 (1.02,1.50)
793 milliners and hatmakers	27	14	2.46 (1.28,4.74)	–	–	–	–	–
welders	174	198	1.03 (0.83,1.27)	1.01 (0.80,1.27)	1.06 (0.66,1.71)	1.01 (0.69,1.48)	0.91 (0.61,1.36)	–
wood workers	326	352	1.04 (0.89,1.22)	1.04 (0.88,1.23)	0.97 (0.58,1.63)	1.06 (0.83,1.36)	1.00 (0.78,1.29)	–
95410 carpenter, general	98	74	1.42 (1.04,1.93)	1.40 (1.03,1.92)	na	1.19 (0.71,2.00)	1.18 (0.71,1.99)	na

'na' zero cases or controls; '– ' <10 cases or <10 controls.

[a]Adjusted for age, sex, and study centre.

[b]Results are not presented for the undertakers occupational group because they included <10 cases or <10 controls.

[c]Results are presented for a specific occupational title within an occupational group if there was a statistically increased or decreased risk of NHL associated with ever or >10 years employment for men and women combined; results are excluded when there were <10 cases or <10 controls.

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Table 4. Adjusted ORs (95%CI) for each of 4 NHL subtypes by occupational title in 22 occupational groups.

	DLBCL (n=3,061)		FL (n=2,140)		CLL/SLL (n=1,014)		PTCL (n=632)		P^d
	Ever employed	>10 years employment	Ever employed	>10 years employment	Ever employed	>10 years employment	Ever employed	>10 years employment	
occupational group[b] and occupational[c] title	OR[a] (95% CI)	OR[a] (95% CI)	OR[a] (95% CI)	OR[a] (95% CI)	OR[a] (95% CI)	OR[a] (95% CI)	OR[a] (95% CI)	OR[a] (95% CI)	
bakers/millers	1.00 (0.70,1.43)	0.92 (0.49,1.73)	0.54 (0.30,0.99)	–	0.89 (0.53,1.48)	1.15 (0.57,2.31)	1.53 (0.86,2.73)	–	0.07
chemical workers	0.85 (0.59,1.22)	1.07 (0.60,1.89)	1.34 (0.92,1.97)	1.72 (0.93,3.17)	0.52 (0.25,1.09)	–	–	–	0.10
cleaners	1.17 (0.98,1.39)	1.10 (0.81,1.50)	1.06 (0.85,1.31)	0.97 (0.66,1.43)	1.05 (0.77,1.42)	1.04 (0.67,1.61)	0.74 (0.47,1.16)	–	0.28
552 charworkers, cleaners & related workers	1.27 (1.03,1.58)	1.18 (0.83,1.67)	1.19 (0.92,1.53)	1.15 (0.76,1.75)	1.14 (0.81,1.62)	1.11 (0.68,1.80)	0.67 (0.38,1.18)	–	0.19
drivers	1.00 (0.86,1.17)	1.00 (0.79,1.26)	1.05 (0.87,1.27)	1.03 (0.77,1.39)	1.02 (0.80,1.31)	0.85 (0.60,1.21)	0.96 (0.70,1.32)	0.84 (0.51,1.37)	0.96
dry-cleaners	1.07 (0.72,1.59)	0.92 (0.35,2.44)	0.73 (0.42,1.26)	–	1.21 (0.67,2.21)	–	–		0.41
electrical&electronic	0.99 (0.84,1.17)	1.03 (0.81,1.32)	1.10 (0.91,1.34)	1.06 (0.79,1.44)	1.12 (0.83,1.50)	1.27 (0.85,1.90)	1.04 (0.74,1.46)	1.39 (0.88,2.19)	0.85
851 electrical fitters	0.76 (0.47,1.24)	0.99 (0.50,1.94)	1.00 (0.58,1.73)	–	–	–	2.02 (1.03,3.97)	–	0.11
engine mechanics	1.12 (0.90,1.39)	1.40 (0.92,2.14)	0.99 (0.75,1.31)	0.80 (0.41,1.56)	0.89 (0.59,1.36)	–	0.70 (0.40,1.24)	–	0.36
farmers-any	1.04 (0.91,1.18)	0.92 (0.77,1.11)	0.99 (0.84,1.17)	1.07 (0.85,1.35)	1.17 (0.98,1.40)	1.16 (0.93,1.45)	0.97 (0.74,1.27)	0.96 (0.67,1.38)	0.41
farmers-animal	0.80 (0.61,1.06)	1.07 (0.74,1.55)	1.08 (0.79,1.48)	0.94 (0.55,1.59)	0.63 (0.42,0.96)	0.69 (0.39,1.21)	0.74 (0.43,1.28)	–	0.18
farmers-crop	1.19 (0.98,1.43)	1.11 (0.83,1.48)	1.07 (0.82,1.38)	1.26 (0.85,1.87)	1.11 (0.85,1.43)	1.32 (0.97,1.79)	1.09 (0.76,1.57)	1.21 (0.75,1.96)	0.88
622 field crop & vegetable farm workers	1.50 (1.15,1.97)	1.16 (0.76,1.78)	1.10 (0.73,1.65)	1.04 (0.53,2.04)	1.20 (0.85,1.69)	1.49 (0.98,2.27)	1.35 (0.82,2.22)	–	0.46
62210 field crop farm worker (general)	1.48 (1.01, 2.17)	1.09 (0.60,1.98)	1.06 (0.57,1.95)	–	1.40 (0.91,2.13)	1.56 (0.93,2.60)	1.73 (0.95,3.17)	–	0.61
farmers-mix&unspecified	1.01 (0.84,1.20)	0.88 (0.68,1.14)	1.00 (0.79,1.25)	1.07 (0.79,1.45)	1.30 (1.06,1.60)	1.17 (0.88,1.55)	0.84 (0.57,1.23)	0.95 (0.57,1.57)	0.11
621 general farm workers	1.13 (0.90,1.42)	1.01 (0.69,1.49)	1.16 (0.87,1.56)	0.91 (0.52,1.59)	1.44 (1.13,1.84)	1.38 (0.94,2.03)	1.14 (0.74,1.78)	1.27 (0.65,2.47)	0.32
fire fighters	0.62 (0.35,1.13)	–	0.78 (0.41,1.49)	–	–	–	–	–	0.86
forestry workers	1.10 (0.66,1.83)	3.04 (1.34,6.90)	–	–	1.24 (0.64,2.43)	–	–	–	0.51
hairdressers	1.47 (1.08,2.00)	1.51 (0.92,2.49)	0.92 (0.60,1.39)	–	1.79 (1.06,3.03)	2.09 (1.01,4.34)	–	–	0.06
57020 women's hairdresser	1.60 (1.13,2.27)	1.44 (0.79,2.62)	0.97 (0.61,1.55)	–	2.69 (1.43,5.06)	–	–	na	0.03
leather workers	0.94 (0.65,1.37)	0.83 (0.43,1.61)	1.10 (0.69,1.75)	–	0.59 (0.31,1.10)	–	1.46 (0.78,2.76)	–	0.28
meat workers	1.14 (0.76,1.70)	1.53 (0.86,2.70)	1.19 (0.75,1.89)	–	0.85 (0.42,1.73)	–	1.22 (0.56,2.65)	–	0.84
medical workers	0.85 (0.72,0.99)	0.99 (0.79,1.24)	1.01 (0.85,1.19)	1.19 (0.93,1.51)	1.10 (0.81,1.49)	1.38 (0.95,2.02)	1.12 (0.82,1.52)	1.13 (0.71,1.80)	0.17
061 medical doctors	1.06 (0.66,1.71)	1.46 (0.79,2.72)	1.29 (0.77,2.18)	2.23 (1.17,4.26)	–	–	–	–	0.93

metal processers	1.34 (0.95,1.90)	1.14 (0.62,2.08)	0.89 (0.52,1.51)	–	1.32 (0.82,2.12)	1.57 (0.78,3.14)	0.92 (0.42,1.99)	0.66 (0.16,2.74)	0.35
723 metal melters and reheaters	2.31 (1.01,5.26)	–	–	na	–	na		na	0.18
metal workers	0.91 (0.76,1.09)	0.86 (0.65,1.15)	1.04 (0.84,1.29)	1.17 (0.84,1.64)	1.18 (0.93,1.52)	1.14 (0.80,1.64)	0.66 (0.45,0.99)	0.71 (0.39,1.29)	0.05
834 machine-tool operators	0.92 (0.68,1.25)	1.34 (0.81,2.21)	1.21 (0.84,1.75)	1.73 (0.93,3.20)	1.08 (0.69,1.69)	1.96 (1.04,3.69)	0.84 (0.45,1.58)	–	0.56
painters	1.03 (0.77,1.39)	1.22 (0.77,1.94)	1.34 (0.95,1.89)	1.27 (0.71,2.28)	0.97 (0.61,1.55)	1.31 (0.70,2.46)	1.80 (1.14,2.84)	–	0.12
93 painters	1.06 (0.78,1.44)	1.31 (0.81,2.13)	1.40 (0.98,1.99)	1.23 (0.66,2.31)	1.05 (0.64,1.72)	1.53 (0.77,3.03)	1.74 (1.07,2.83)	–	0.22
93930 spray-painter (except construction)	1.74 (0.90,3.37)	–	2.67 (1.36,5.25)	–	–	–	1.31 (0.31,5.62)	–	0.61
printers	0.88 (0.65,1.19)	1.36 (0.85,2.19)	1.16 (0.83,1.61)	1.02 (0.52,2.01)	1.37 (0.85,2.22)	1.27 (0.61,2.67)	0.92 (0.50,1.70)	–	0.38
922 printing pressmen	–	–	–	–	6.52 (2.79-15.21)	–	–	na	0.02
teachers	0.88 (0.76,1.01)	0.88 (0.72,1.08)	0.95 (0.82,1.11)	0.93 (0.74,1.17)	0.99 (0.76,1.30)	1.00 (0.69,1.43)	0.94 (0.70,1.26)	1.13 (0.75,1.70)	0.79
131 university and higher education teachers	0.81 (0.61,1.07)	0.89 (0.59,1.33)	0.62 (0.44,0.89)	0.72 (0.43,1.19)	0.85 (0.49,1.47)	–	1.03 (0.59,1.80)	–	0.37
134 pre-primary education teachers	0.89 (0.61,1.31)	1.46 (0.76,2.78)	0.98 (0.66,1.46)	–	2.00 (1.04,3.87)	–	–	–	0.10
135 special education teachers	1.94 (1.01,3.71)	–	–	–	–	–	–	na	0.54
textile workers	1.19 (1.01,1.41)	1.20 (0.93,1.54)	0.94 (0.75,1.17)	0.85 (0.59,1.23)	1.01 (0.78,1.30)	0.93 (0.64,1.35)	1.60 (1.18,2.17)	2.18 (1.45,3.30)	0.02
75 spinners, weavers, knitters, dyers & related workers	1.09 (0.84,1.42)	1.08 (0.73,1.61)	0.81 (0.55,1.18)	0.73 (0.39,1.38)	1.08 (0.74,1.56)	1.09 (0.62,1.89)	1.85 (1.21,2.83)	1.90 (1.00,3.64)	0.03
79 tailors, dressmakers, sewers, upholsterers & related workers	1.20 (0.99,1.47)	1.23 (0.90,1.69)	1.02 (0.79,1.31)	1.03 (0.67,1.59)	0.94 (0.68,1.30)	0.86 (0.52,1.41)	1.35 (0.92,1.99)	2.29 (1.38,3.77)	0.41
793 milliners & hatmakers	2.90 (1.30,6.45)	–	–	–	–	na	na	na	0.62
795 sewers & embroiderers	1.51 (1.16,1.96)	1.56 (1.00,2.42)	1.01 (0.71,1.44)	–	1.05 (0.68,1.63)	1.09 (0.55,2.19)	1.26 (0.72,2.21)	–	0.20
welders	1.31 (0.99,1.74)	1.20 (0.70,2.05)	0.81 (0.53,1.23)	1.25 (0.63,2.49)	0.97 (0.59,1.60)	–	0.66 (0.31,1.42)	1.08 (0.39,3.02)	0.09
wood workers	1.12 (0.89,1.41)	1.22 (0.85,1.75)	0.95 (0.70,1.29)	0.97 (0.58,1.62)	1.01 (0.71,1.43)	0.95 (0.56,1.60)	1.54 (1.04,2.27)	2.04 (1.19,3.50)	0.15
811 cabinetmakers	0.72 (0.41,1.28)	–	0.98 (0.51,1.86)	–	–	–	2.41 (1.22,4.74)	–	0.04
95410 carpenter, general	1.14 (0.71,1.81)	–	1.49 (0.91,2.44)	–	2.10 (1.08,4.09)	–	–	–	0.18

'na' zero cases or controls; '– ' <10 cases or <10 controls.

[a]Adjusted for age, sex, and study centre.

[b]Results are not presented for the following occupational groups because they included <10 cases or <10 controls: pulp&paper workers, petroleum workers, undertakers.

[c]Results are presented for a specific occupational title within an occupational group if there was a statistically increased or decreased OR for at least one subtype associated with ever or >10 years employment for men and women combined; results are excluded when there were <10 cases or <10 controls.

[d]Q-test for heterogeneity across the four subtypes, based on ORs for ever employment in the occupation in men and women combined.